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ABSTRACT

The Oregon Electronics Worksite Training Program created a system for delivering vocational education and training to individuals employed within the electronics and manufacturing industry in the Portland metropolitan area. The approach selected by Portland Community College was to use interactive video instructional materials in a self-study, individualized, open-entry/open-exit format to provide the flexibility needed to accommodate a wide variety of work schedules and situations. Interactive-video instructional materials created by the College of San Mateo (California) were purchased for a direct current (dc) electronics course and were made available at an electronics worksite installed at the Intel Corporation. Seven students were active in the program during the initial evaluation period--from April to June of 1984. Most of these students made progress comparable to students who had used the software at the College of San Mateo. Recommendations were made for refining the program for the future, including the following: (1) increase the number of students enrolled (the worksite station could support 15 to 20 students); (2) establish an open-entry/open-exit format for admitting students; (3) establish attendance rules and strictly enforce them; (4) establish a waiting list of students for the program; (5) increase publicity about the course; (6) make the job of the instructor who interacts with the field site a regular, full-time job; and (7) hire a project director to manage and promote the program. Portland Community College intends to continue the Intel worksite training program, and to purchase additional courses; namely, alternating current (ac) electronics and semiconductors. (KC)

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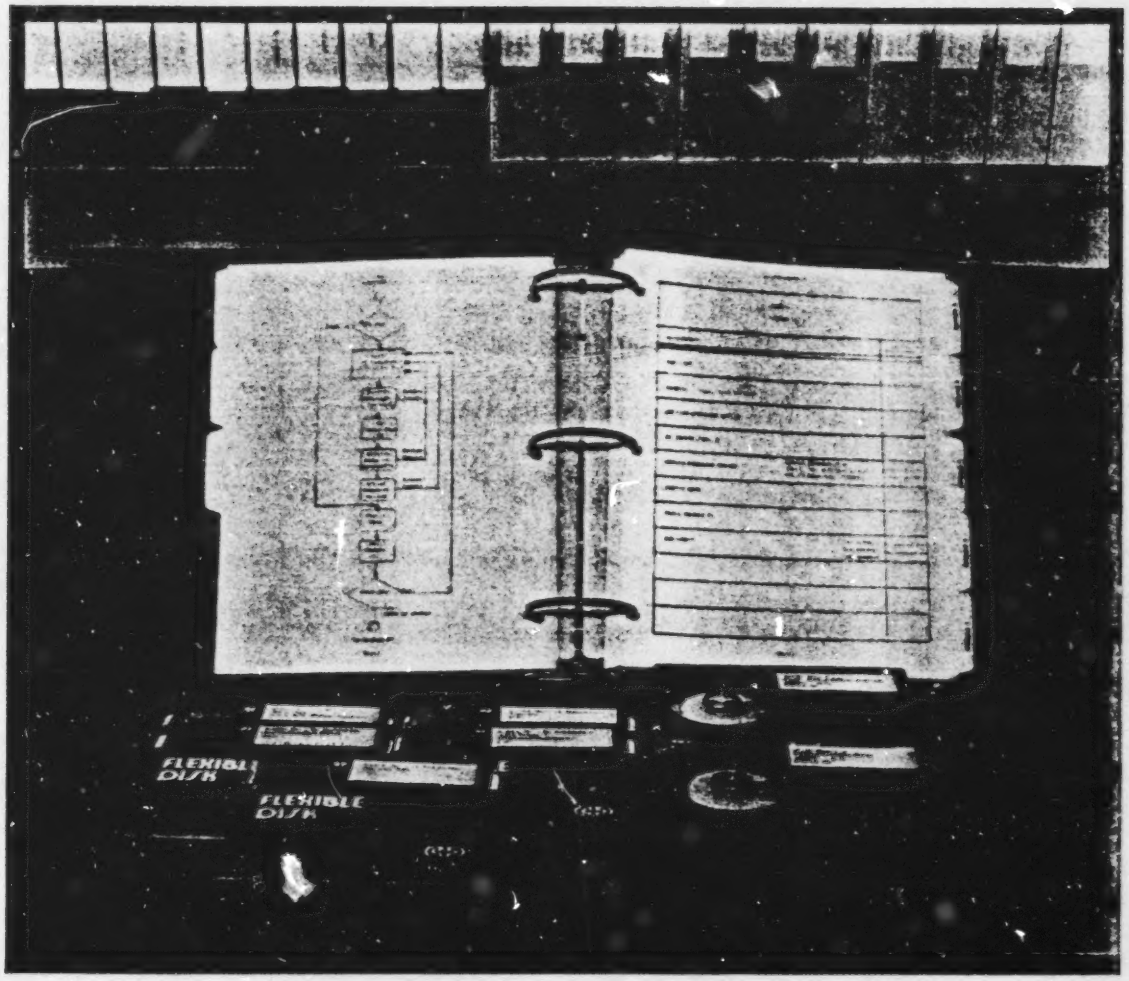

FIGURE 1. THE DC ELECTRONICS COURSE MATERIALS INCLUDE A STUDENT BINDER, VIDEOTAPES, AND SOFTWARE STORED ON DISKETTES.

BACKGROUND

The goal of the Oregon Electronics Worksite Training Project was to plan, develop, and implement an alternative and non-traditional strategy for delivering vocational education and training to individuals employed within the electronics manufacturing industry in the Portland metropoitan area. The approach selected was to use interactive-video instructional materials in a self-study, individualized, open-entry/open-exit format to provide the flexibility needed to accomodate a wide variety of work schedules and situations.

The Electronics Worksite Training Program, in order to fit the criteria for an alternative and non-traditional instructional delivery strategy differs from on-campus courses in the following ways. First, the design of the course utilizes computer-based instruction which marries the interactivity of the computer with video storage technology in the form of videocassettes. Through the interaction of text, video, and interactive program segments, students can develop the necessary skill set needed for advancement to higher technical positions within their respective companies.

Second, the instructional setting is different. Certainly, courses have been offered at company sites so the location is not in itself new. In fact, in most cases, offering a course at a company site involves no more than changing the location, i.e. courses are often held in conference rooms or in cafeterias which

emulate the on-campus classroom. What is envisioned for the Electronics Worksite Training Program is a student lab at the worksite consisting of the computer/videotape system, basic electronics test instruments, and associated parts and supplies.

Third, the operation of the Electronics Worksite Training Program will require the role of the instructor to change. Instead of being the main vehicle for the delivery of information, the instructor will need to become more of a facilitator, motivator, and manager of the instructional process.

And lastly, the Electronics Worksite Training Program addresses a need not currently being met by on-campus courses and demonstrates the ability of the community college to respond to a specific need for training within the commmunity being served. Such responsiveness will strengthen the partnership that already exists between the college and the business community.

PROJECT GOALS

To reiterate, the Electronics Worksite Training Program was structured in a manner to prepare workers with an stronger technical skill set in order to facilitate advancement in their technical careers. The instructional program would be delivered using unique and innovative, non-traditional techniques geared to the needs of the worker who, because of full-time work responsibilities and non-traditional work schedules, could not benefit from conventionally scheduled on-campus courses.

Therefore, interactive-video instructional materials would be used to produce an individualized, self-paced, competency-based, and open-entry/open-exit system with the following goals:

(1) Identify, develop, and implement an alternative and non-traditional strategy for delivering instruction to ensure the student is more quickly able to be successful on the job for which he/she was trained and for advancement to areas of greater responsibility.

(2) Develop a model partnership between local industry and the community college to enhance vocational education.

(3) Utilize the resources of the worksite to encourage flexible vocational educational programming, e.g. self-paced, individualized, competency-based, open-entry/open-exit.

(4) Utilize the worksite in industry as training stations for existing and emerging occupational fields and to interface worksite training with existing cooperative education programs.

(5) Identify, develop, and implement an accessible alternative mode of instruction that is more time-, energy-, effort-, and cost-effective for the student.

(6) Develop and implement innovative ways of programming and delivering technical training programs in order to to respond to the changing high-tech employment opportunities.

PROJECT SETTING

The worksite selected was the Hillsboro Plant of Intel Corporation. Intel was selected because of the strong partnership that has developed over the past five years between the College and Intel's Oregon Site.

The Hillsboro Site possessed several key attributes which made it an ideal worksite test site. These attributes are:

(1) Intel Corporation's projection for the Hillsboro Site indicated significant future growth.

(2) The Oregon Site had a significant number of employees on non-traditional work schedules, e.g. compressed work week.

(3) Intel's internal education policy encourages technical growth in their employees and the company, as a whole, has a corporate commitment to education.

(4) Intel and Portland Community College had already established a successful partnership in other areas such as cooperative education.

INSTRUCTIONAL STRATEGY

Early in the project, the project team visited the College of San Mateo to gain first hand information on the development of interactive-video instructional materials and to view first hand an operating worksite training program. The project staff spent two days at the College of San Mateo and at various worksites.

As a result of this visit, the decision was made not to attempt to develop any interactive-video instructional units. The monies from the grant would not support the development staff

that would be needed for such an effort. Even to take a set of videotapes such as Texas Instrument's dc course and make it interactive were far too ambitious for the staff within the time and financial contraints of the grant.

Therefore, it was decided to purchase prerecorded instructional matterials produced by the College of San Mateo and distributed through the Wisconsin Foundation. This would allow the project staff to focus on other aspects of worksite training: site development, interaction with company training specialists, redefining the instructor's role, and operation of a pilot worksite training program at the Intel worksite.

In March of 1984, a student station was configured for the dc electronics course at the Hillsboro plant. Equipment was inventoried and property passes were issued in order to place the equipment within the Intel plant. Security clearances were arranged for the students that would be coming from other parts of the plant.

Course announcements were issued within the Intel plant and thirty individuals applied for admission into the course. Since the course was offered under EL 6.112 Resistive Circuits, a required course in the first term of the Electronic Engineering Technology (EET) Program, students had to meet the prerequisites for the EET Program. These prerequisites included placement into college algebra and the freshman English sequence.

Nine students of the thirty applicants met the entry requirements and were admitted into the course. Four of the eight were female. All were full-time Intel employees and were

taking the class for career advancement purposes.

Two instructors from the Electronic Engineering Technology Program were involved in the operation of the pilot program. One served as "Field Instructor".

MAJOR ACCOMPLISHMENTS AND OUTCOMES

The main accomplishment was the establishment of a pilot worksite training program at the Hillsboro plant of Intel Corporation as an alternative instructional system. The students selected, because of a number of reasons ranging from work schedule to geographic isolation to the need for flexible training in light of prior background, expressed a preference for the individualized, self-paced format of the interactive-video instructional program.

ACQUISITION OF COURSE MATERIALS

The summer prior to Fall Term 1983 was spent acquiring and familiarizing the project staff with the College of San Mateo produced interactive-video dc electronics course. The interactive dc electronics course consisted of theory, skill development, laboratory, and evaluation modules. Project staff members worked through each of these components for several modules as students would work through them during the pilot program to gain first hand experience with the instructional program.

In addition, project staff members became familiar with the computer-based record keeping system used by the CSM produced

course. Initially, lack of documentation was a serious road block to using the system. On site consultation provided by the College of San Mateo was extremely helpful in learning the file management system used. Subsequent development of a "Field Instructor°s Guide" greatly improved the documentation needed by first time users.

The on-site consultation also allowed the consultant team to verify proper operation of the course materials. Several problems were identified with the software recorded on the seventy-two diskettes and replacement disks were provided by the College of San Mateo. One case of a poorly duplicated videotape was also identified and the videotape was replace.

Proper installation of the instructional program is very important. The most effective method of starting up a new site is for experienced users to visit the new site and train the new users how to use and manage the instructional program.

INDUSTRY COORDINATION

Because of PCC's established programs with Intel Corporation, the contacts for setting up the worksite program were in place. The project staff worked through the College Relations Department at the Hillsboro plant. The College Relations Coordinator was very receptive to the concept.

Despite interest in the worksite training program, the program, initially slated to start during Fall Term 1983, was delayed for one term and did not begin until mid-Winter Term

1984. Two reasons accounted for this. First, personnel changes within the College Relations Department at Intel moved the worksite training program down the priority queue and internal projects took priority. Second, because of rapid growth at the Oregon site, space was difficult to acquire for the student station.

One thing that became very evident was the need for active participation by the College Relations Department. Besides space, the College Relations Department supported the program by obtaining property passes for the equipment, advertising the program through internal channels, and insuring clearances into the area for Intel employees from other locations within Intel.

In February of 1984, the students for the worksite pilot program were selected and the student orientation session was held. The orientation was about an hour and a half in length. Content included the organization of the pilot program, the record keeping system, the course materials, and the schedule to be used at the student station. The orientation meeting was followed by a group demonstration of the interactive-video student station.

Normally, it takes about six months to complete the interactive dc course. Because of the late start, the project staff did not have time to complete a final evaluation of the course and establish its equivalence or non-equivalence to the on-campus sections of the same course. In the original plan, the course was to be completed during the Spring of 1984 with a quality control check between the worksite pilot program and on-campus courses to be completed by June of 1984.

Students who actively participated in the course progressed at a similar rate as sttudents using the same materials through the College of San Mateo worksite training program. See Evaluator's Report.

The instructor assigned as Field Instructor had both on-campus teaching responsibilities as well as the responsibilities of managing the worksite pilot program. It was found that insufficient time was given to the worksite program as a result. It is very important that the Field Instructor be available at the worksite on a defined weekly schedule. Furthermore, the Field Instructor must interface or communicate with the students frequently in order to address problems with the course materials or just to encourage and motivate the students.

An Adopter's Guide was developed to assist other institutions in setting up their own worksite training programs. In addition, the Wisconsin Foundation has available a Field Instructor's Handbook that provides specific detailed information on the use of the computer-based file management system.

DISSEMINATION OF PROJECT RESULTS

One workshop was held for those individuals within the State of Oregon who had an interest in interactive-video instruction. Invitations were sent to all thirteen community colleges. Seventeen individuals representing community colleges, secondary schools, educational service districts, and the State Department of Education attended the workshop.

For those unable to attend, the Adopter's Guide that was developed as a part of this grant can serve as an introduction to the content, philosophy, and operation of an electronics worksite training program.

PROBLEMS

As with any pilot project, several unanticipated problems did occur which impacted the operation of the worksite program. To begin with, the start date of the pilot study was pushed back from September, 1983 to February, 1984. This was caused by several factors. The first factor was the transience of individuals in specific positions at Intel. As it turned out, the individuals that supported the initial grant proposal either changing jobs, or going on sabbatical and not participating in the actual implementation of the program. Hence, the need arose to orient new individuals to the goals and objectives of the project and to enlist their support.

Second, with rapid growth within the Intel plant and the premium placed on floor space, the acquisition of a suitable cubicle for the student lab took time. The Intel representative was the main driving force in acquiring this space.

Third, with changes in personnel, the start-up of the pilot program did not receive high priority within the College Relations Department. This was not necessarily avoidable but nevertheless a fact of life within the electronics industry.

Another problem that occurred was the lack of an alternative for those individuals that had to exit the Intel pilot program

before completing the course. For example, one of the participants left the employment of Intel after only two of the fourteen modules. Since there were no alternative sites that could provide access to the student station needed to continue the program of studies, PCC had no option but to refund this student's tuition. What was needed was a student station on the Sylvania or Rock Creek campuses that students could used if they transferred to a company not currently participating in the worksite training program.

Students also exitted the program before completing the course when they were transferred to other Intel locations, e.g. Folsum, California. There is no real solution to this problem since the student moves out of the geographic sphere of the worksite training program.

The last major problem encountered was the availability of the field instructor. For the worksite program to be effective, the individual serving as field instructor must be full-time. It did not work to have a part-time field instructor who had to split his teaching responsibilities between on-campus and worksite teaching/management responsibilities. Availability and access are crucial issues. Students must be able to accessthe field instructor for help with the material, instruction in the use of the software, and encouragement over the rough spots.

Along with this, it is also imperative that a full-time project director be appointed. It takes a significant amount of time and effort to establish working arrangement with companies. The project director must sell the concept to company training

departments, order the necessary hardware and software materials, and work within the structure of the organization to schedule courses and register students. Hence, the minimum staff required would be two individuals, a field instructor and a project director.

A future issue to be addressed is "What other interactive-video courses will be offered?" Portland Community College will be purchasing two additional courses produced by the College of San Mateo. One course will be the companion course to dc electronics, namely the ac electronics course. The third course is a course on semiconductor fundamentals.

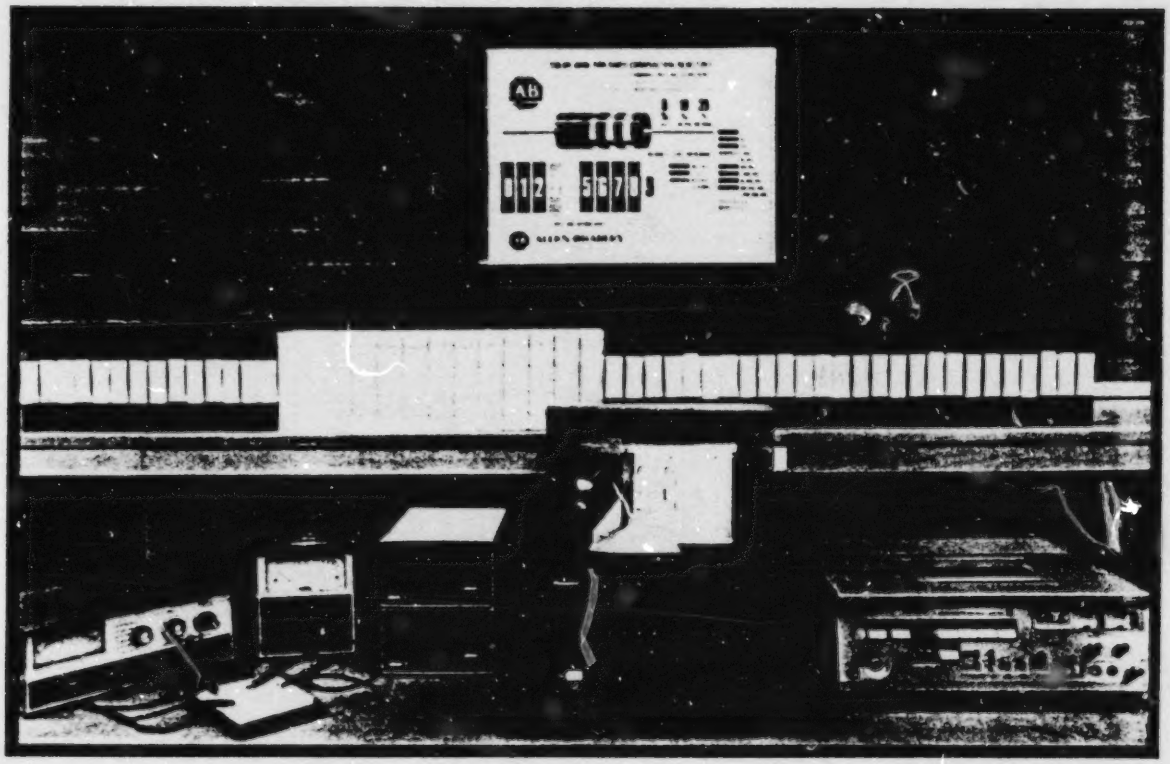

Figure 2. TRAINING STATION SET-UP SHOWING THE COMPUTER-VIDEOTAPE SYSTEM, ELECTRONIC TEST EQUIPMENT, AND INSTRUCTIONAL MATERIALS.

PROJECT EVALUATION

The evaluation period was from April, 1984, to June, 1984. Although the evaluation period is considerably shorter than originally anticipated, the results show a very reasonable amount of progress has been attained in the two months considered. Figure 3 shows the Group File printouts for the evaluation period.

Before considering the actual progress information shown in Figure 3, it may be helpful to define some terms which will be used in this evaluation. The Group File listing shows student progress in each of the four activitiy categories:

A -- Pre/Post Tests

B -- Theory Lessons

C -- Lab Jobs

D -- Skill Modules

Included in the Appendix is a list of required activities for the entire dc electronics course. This list may be consulted for a comparison of student progress. The most important categoryis the Group File listing is Column "A", because it shows the current module in which the student is working. The other three categories show the last activity completed for each category. By comparing the list of required activities to the Group File printout for a particular student, it is possible to get a very accurate picture of the actual progress made by each student.

Of the nine students who entered the program in April, two will not be considered due to circumstances which did not allow

INITIAL PRINTOUT

USER: INTEL CORPORATIN

NAME	CURRENT ACTIVITY A	B	C	D
BARCLAY DARIA	1-00	1-00	1-00	1-00
BATES MARK	5-00	4-03	1-01	1-00
GUNN GEORGE	6-00	1-00	1-00	1-00
HOAGLAND TED	5-00	12-06	1-01	3-02
HUGHES MEL	2-02	11-09	1-01	9-02
INGRAM TERRY	3-01	1-00	1-00	1-00
KRAHMER ART	1-00	1-00	1-00	1-00
GLADDEN CHARLA	3-01	3-02	1-00	9-02
YARGUS KAREN	2-04	2-01	1-00	1-00

FINAL PRINTOUT

USER: INTEL CORPORATION

NAME	CURRENT ACTIVITY A	B	C	D
BARCLAY DARIA	1-00	1-00	1-00	1-00
BATES MARK	7-00	7-04	1-01	1-00
GUNN GEORGE	6-00	1-00	1-00	1-00
HOAGLAND TED	7-00	9-09	8-07	4-04
HUGHES MEL	7-04	9-20	8-09	3-03
INGRAM TERRY	3-01	1-00	1-00	1-00
KRAHMER ART	1-00	1-00	1-00	1-00
GLADDEN CHARLA	6-01	12-07	3-03	3-03
YARGUS KAREN	2-04	12-07	6-05	4-05

FIGURE 3. GROUP FILE LISTINGS FOR THE WORKSITE PILOT STUDY.

them to remain in the training program:

Terry Ingram had to drop the course due to leaving the company.

Daria Barclay was on medical leave at the time of the final evaluation.

An evaluation of each student's progress during the evaluation period is as follows:

Mark Bates advanced from Module 5 to Module 7. This is reasonable progress, particularly since Module 5 contains three theory tapes, four lab jobs, one skill module, and two additional activities.

George Gunn remained in Module 6 during the evaluation period. It is evident that George has not spent much time in the program.

Ted Hoagland advanced from Module 5 to Module 7.

Mel Hughes advanced from Module 2 to Module 7. This is extremely good progress considering the amount of material he had to cover.

Art Krahmer was transferred to another Intel plant outside of Oregon.

Charla Gladden advanced from Module 3 to Module 6. Again, this was very good progress.

Karen Yargus remained in Module 2. This is a difficult module, particularly for those with a weak math background. She probably needs some individual help to move beyond this module.

The above comments are based on the fact that students are exprected to attend training three hours per week, or twelve hours per month. At this rate, the average student will complete the entire dc electronics course in approximately six months. Therefore, the progress of this group is quite average considering the evaluation period.

Progress at the Intel program was compared to progress results at several company sites in the worksite training program at the College of San Mateo. The progress at the two sites were very similar.

RECOMMENDATIONS FOR THE FUTURE

At this point, it is important to consider the future of this particular training program at Intel Corporation. It is off to a very good start and has promise of providing a very valuable training resource to the company. Below are listed some factors to consider in terms of continued operation of the training program.

1. Increase the number of students enrolled. The present number of nine (seven active) is not really benefitting the company as it could. The training station is capable of supporting between fifteen and twenty student at a time.
2. Establish an "open-entry/open-exit format for admitting students. This creates a general feeling of openness for the program and emphasizes the great flexibility of the training program. The self-paced format allows for this flexibility and increases the utilization of the student

station.

3. Establish attendance guidelines and strictly enforce them. Employees need to know their limits. The more serious students will attend regularly if they know their attendance and progress is being monitored on a regular basis.

4. Establish a waiting list of students waiting to enter the training program. This tends to attract more serious students to the program in the first place and lets currently enrolled students know that their time slot will be backfilled if they are not using it.

5. The field instructor should make an effort to get to know the supervisors and managers of the currently enrolled students. If supervisors are aware of the training program and the services it is providing, tney are more likely to promote and upgrade employees who have completed all or part of the training program. This, after all, is really the final evaluation of the program -- using the training on the job for the betterment of both the employee and the company.

6. Some method of screening should be used when entering prospective students into the program. The primary consideration should be to first consider those students who can benefit directly from the training on the job (e.g. assemblers, test technicians), then those who benefit indirectly (e.g. customer service representatives, inventory clerks), and finally those who really cannot use the knowledge on the job at all but may anticipate a job change in the future into the technical area. This method of

screening is helpful when there are more applicants than openings and decisions need to be made as to who will enter the program and who will be placed on the waiting list.

7. Another helpful tool is an entrance exam. This exam should typically test basic aptitudes for electronics without testing knowledge in electronics. Knowledge in basic mathematics and algebra is a must and some testing on logical reasoning and problem solving would be very helpful in determining whether or not an applicant will be successful in the training program. There are a number of standardized tests available which will help satisfy this requirement.

8. When open slots exist on the training station and there are few names on the waiting list, it is a good idea to promote the training program through publicity. This is most effectively done through articles in the company newspaper, flyers posted on company bulletin boards, and memos to supervisors. Of course, the most effective method of advertising the program is word-of-mouth from employee to employee. However, this usually takes some time to initiate before it is an effective method.

9. Graduates from the course are one of the best ways of promoting it in the future. When entering students see that a number of their fellow employees have completed the program, it seems like a much more reasonable goal for them to complete it as well. This is particularly true if these graduates have received promotions or better or more

interesting jobs as a result of the training.

10. The field instructor should always strive to maintain very close contact with each student on a one-to-one basis. The cornerstone of the training program is the fact that the instructor is a resource to the student when needed, answering questions or solving problems which the student cannot handle on his/her own. If students feel they can get assistance from the instructor when they need it, they are much more willing to put forth the effort required for them to complete the training.

EVALUATOR'S CONCLUSIONS

As with any new program, the Electronics Worksite Training Program needs a reasonable amount of time to be accepted as a regular part of the company environment. Portland Community College°s program is achieving these goals and should become very successful. It is important to realize that the best instructional designed package will not be successful without proper implementation. An on-site or field instructor who places his students as top priority and works with them on an individual basis as they progress through the program is virtually guaranteeing the success of the program at the company.

The project evaluator was Mr. Thomas Diskin, Field Instructor for the College of San Mateo, CWETA Office, College of San Mateo, 1700 W. Hillsdale Blvd., San Mateo, CA 94402.

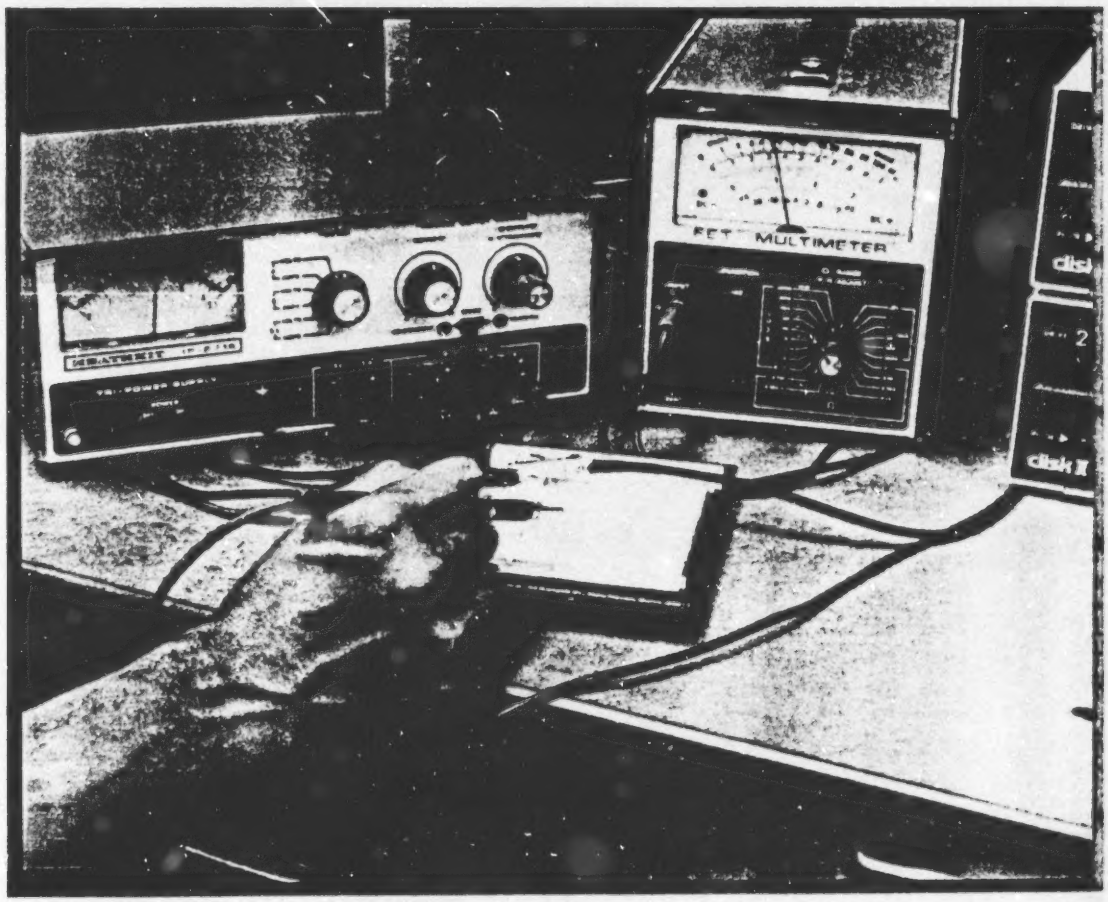

FIGURE 4. AN IMPORTANT COMPONENT IN THE INSTRUCTIONAL PACKAGE IS THE LABORATORY ACTIVITY. INTERACTIVE LAB JOBS ENABLE STUDENTS TO DEVELOP KEY OCCUPATIONAL SKILLS.

CONCLUSIONS AND SUMMARY

The Intel Pilot Project has shown that interactive-video instruction can be used as the basis for a worksite training program. Courses can be purchased that include theory, laboratory, skill development, and evaluation components. It is recommended that institutions desiring to implement a worksite training program in their community should purchase rather than develop their own instructional materials. The main consideration is cost of development that can run into the hundreds of thousand dollars and time, a minimum of a year to develop a complete course.

The crucial element in the worksite training program is the field instructor. The field instructor must devote his full attention to the management of the program and provide the personal contact needed by the student. Regular contact is so crucial to monitoring student progress and motivating the student to keep progressing through the course.

The cost of the student station and educational materials is not cheap. The student station itself can cost up to $10,000 with each set of software running about $5,000. Software can be shared between several student stations as each student will probably be on a different diskette and/or videotape at any given time.

Interactive video provides the ability to offer instruction in remote locations and in this case, in the environment where the student works. This expands the reach of campus-based programs.

The establishment and operation of a worksite training program promotes interaction and cooperation between the College and the community the college serves. The end result is a wider variety of educational opportunities for employees who because of their work schedules and responsibilities cannot avail themselves of on-campus course offerings.

RECOMMENDATIONS

The most crucial need is to fully fund a field instructor position and a part-time project director. It is a full-time job to visit the worksites and provide the one-on-one interaction with each student in the program. The project director is needed to perform the development function needed to expand the training program to other companies.

Additional student stations, copies of the dc electronics course, and following courses need to be purchased. It is important that the dc electronics course be the first course in a sequence of courses. Currently, courses in ac electronics and semiconductors are available with a course in digital electronics to be available during the summer of 1985. This is a solid core of electronics courses.

Staff development activities have to be developed to train field instructors. Potential field instructors need to be trained not only in the operation and maintenance of the equipment but also in the personal communications skills needed to counsel and motivate the students.

PROJECT FOLLOW-UP AND COMMITMENT

Portland Community College will continue the Intel worksite training program. If student interest continues to increase, additional student stations will be added to the exising laboratory at the Intel plant.

The College has budgetted $50,000 for worksite training during the 1984-85 academic year. Of this amount, $20,000 will be used to purchase additional equipment and $30,000 will be used to purchase additional courses, namely ac electronics and semiconductors.

The College has also submitted a proposal to the Fred Meyer Charitable Trust for monies to continue development of the worksite training program. A decision is anticipated during November of 1984.

APPENDICES

DC ELECTRONIC COURSE CONTENT

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Measuring Current

Theory Tape # 2 - Scientific Notation and Metric Prefixs

Skill Module # 1 - Volts-Amps-Ohms-Watts

Appendix: Scientific Notation

MODULE THREE - ELECTROMOTIVE FORCE

Electrical Force

Producing EMF

Batteries

Theory Tape # 3 - Electromotive Force

Skill Module # 8 - Meter Scales

Skill Module # 9 - The Analog Multimeter

Skill Module # 10 - The Digital Multimeter

Theory Tape # 9A - The Voltmeter

Lab Job # 1 - Measuring Voltage

MODULE FOUR - BATTERIES AND VOLTAGE DROPS

Connecting Batteries

Voltage Rises and Voltage Drops

Concept of Ground

Measuring Voltage

Theory Tape # 4 - Voltage Rises and Drops

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MODULE FIVE - RESISTANCE

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Resistors

Connecting Resistors

Color Code Disk

Skill Module # 3 - The Calculator: Prefixes and Resistance Problems

Theory Tape # 5A - Resistance

Theory Tape # 5B - Series-Parallel Resistive Circuits

Theory Tape # 9B - The Ohmmeter

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Lab Job # 3 - Using the Lab Breadboard

Lab Job # 4 - Continuity, Opens and Shorts

Lab Job # 6 - Measuring Resistance Characteristics

MODULE SIX - OHM'S LAW AND POWER

Ohm's Law

Power

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Theory Tape # 6 - Ohm's Law and Power

Lab Job # 7 - Verifying Ohm's Law

Lab Job # 8 - Power

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Electricity and Magnetism

Induction

Magnetic and Electromagnetic Applications

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Theory Tape # 7B - AC and DC Generators

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Lab Job # 10 - Magnetic and Electromagnetic Devices

MODULE EIGHT - CURRENT AND AMMETERS

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Simple Circuits

Voltage Dividers

Theory Tape # 10A - Series-Parallel Resistive Circuits

Theory Tape # 10B - Voltage Dividers

Lab Job # 11 - Loading Effects of Voltmeters

MODULE ELEVEN - CIRCUIT ANALYSIS

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Kirchhoff's Law

Superposition Theorem

Theory Tape # 11A - Kirchhoff's Law

Theory Tape # 11B/12 - Superpositon Theorem, Thevenin's Theorem, Norton's Theorem
Lab Job # 12 - Resistance Bridge Circuits

MODULE TWELVE - THEVEN'S AND NORTON'S THEOREM

Thevenin's Theorem

Norton's Theorem

Theory Tape # 11B/12 - Superpostion Theorem, Thevenin's Theorem, Norton's Theorem

MODULE THIRTEEN - INDUCTANCE AND CAPACITANCE

Inductance

Capacitance

Capacitors

Theory Tape # 13 - Inductors and Capacitors

MODULE FOURTEEN - CAPACITIVE CIRCUITS

RC Time Constants

Capacitors in Combination

Theory Tape # 14 - RC Time Constants

Lab Job # 13 - RC Time Constants

Lab Job # 14 - Capacitors in Series and parallel

Lab Job # 15 - Using Capacitors

LAB JOB TITLES

LAB JOB 1	MEASURING VOLTAGE
LAB JOB 2	MEASURING RESISTANCE
LAB JOB 3	USING THE LAB BREADBOARD
LAB JOB 4	CONTINUITY, OPENS, AND SHORTS
LAB JOB 5	MEASURING CURRENT
LAB JOB 6	MEASURING RESISTANCE CHARACTERISTICS
LAB JOB 7	VERIFYING OHM'S LAW
LAB JOB 8	POWER
LAB JOB 9	ELECTROMAGNETISM
LAB JOB 10	MAGNETIC AND ELECTROMAGNETIC DEVICES
LAB JOB 11	LOADING EFFECTS OF THE VOLTMETER
LAB JOB 12	THE RESISTANCE BRIDGE CIRCUIT
LAB JOB 13	RC TIME CONSTANTS
LAB JOB 14	CAPACITORS IN SERIES AND PARALLEL
LAB JOB 15	USING CAPACITORS

SKILL MODULE TITLES

SKILL MODULE 1	VOLTS, AMPS, OHMS, WATTS
SKILL MODULE 2	THE CALCULATOR - GETTING STARTED
SKILL MODULE 3	THE CALCULATOR - PREFIXES AND RESISTANCE PROBLEMS
SKILL MODULE 4	THE CALCULATOR - PREFIXES AND OHM'S LAW PROBLEMS
SKILL MODULE 8	METER SCALES
SKILL MODULE 9	THE ANALOG MULTIMETER
SKILL MODULE 10	THE DIGITAL MULTIMETER

EVALUATOR'S REPORT

TO: David Hata DATE: June 18, 1984

FROM: Tom Diskin

SUBJECT: Final Evaluation of Electronics Worksite Training Program at Portland Community College, Portland, Oregon

On June 8, 1984 I visited the Portland Community College Electronics Worksite Training station at Intel Corporation's Jones Farm facility near Portland, Oregon for a final evaluation. This report contains a description of the status of the training program at the time of the visitation, and recommendations for the continued growth of the program.

Attached to this report are copies of initial and final progress reports, based on Group File printouts from the System Manager computerized record keeping system. The evaluation period in this case is only two months; the first (initial) report was taken in April 1984 and the final report in June 1984. Although the evaluation time period was considerably shorter than originally anticipated, the results show a very reasonable amount of progress has been attained in the two months considered. Figure 1 shows the two Group File printouts, and Figures 2 and 3 show the initial and final Log File printouts, respectively. The two Log File printouts are really not a necessary part of this evaluation; they are included to give some idea of the amount of time required to achieve the progress reflected in the Group File printouts.

STUDENT PROGRESS EVALUATION

Before considering the actual progress information shown in Figure 1, it may be helpful to define some terms which will be used in this evaluation. The GROUP FILE listing shows student progress in each of four activity categories:

A -- Pre/Post Tests
B -- Theory Lessons
C -- Lab Jobs
D -- Skill Modules

Attached to this report is a list of required activities for the entire DC Electronics course. This list may be consulted for a comparison of student progress. The most important category in the Group File listing is Column "A", because it shows the current module in which the student is working. The other three categories show the last activity completed for each category. By comparing the list of required activities to the Group File printout for a particular student, it is possible to get a very accurate picture of actual student progress.

Of the nine students who entered the program in April, two will not be considered due to circumstances which did not allow them to remain in the training program:

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Terry Ingram -- Had to drop the course due to leaving the company.

Daria Barclay -- Was on medical leave at the time of the final evaluation.

An evaluation of each student's progress during the evaluation period follows:

Mark Bates -- advanced from Module 5 to Module 7. This is reasonable progress, particularly since Module 5 contains 3 theory tapes, 4 lab jobs, 1 skill Module and two additional activities.

George Gunn -- remained in Module 6 during the evaluation period. It is evident that George has not spent much time in the program.

Ted Hoagland -- advanced from Module 5 to Module 7.

Mel Hughes -- advanced from Module 2 to Module 7. This is extremely good progress considering the amount of material he had to cover.

Art Krahmer -- remained in Module 1.

Charla Gladden -- advanced from Module 3 to Module 6. Again, very good progress.

Karen Yargus -- remained in Module 2. This is a difficult module, particular for those with a weak math background. She probably only needs some individual help to move beyond this module.

The above comments are based on the fact that students are expected to attend training 3 hours per week, or 12 hours per month. At this rate, the average student will complete the entire DC Electronics course in about six months; therefore, the progress of this group is quite average considering the evaluation period.

I have compared these progress results with several of my company sites in the College of San Mateo program, and have found them to be quite similar.

RECOMMENDATIONS FOR THE FUTURE

At this point, it is important to consider the future of this particular training program at Intel Corporation. It is off to a very good start, and has promise of providing a very valuable training resource to the company. Below are listed some factors to consider in terms of continued operation of the training program.

1. Increase the number of students enrolled. The present number of 9 (7 active) is not really benefiting the company as it could. The training station is actually capable of supporting between 15 to 20 students at a time.

2. Establish an "open entry/open exit" format for admitting

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students. This creates a general feeling of openness for the program, and emphasizes the great flexibility of the training program. The self-paced format allows for this flexibility; utilizing the training station as much as possible also looks like a better investment to the company, whether they are paying for it or not.

3. Establish attendance guidelines and strictly enforce them. Employees need to know their limits; most serious students will attend regularly if they know their attendance and progress is being monitored on a regular basis.

4. Establish a waiting list of students waiting to enter the training program. This tends to attract more serious students to the program in the first place, and lets currently enrolled students know their time slot will be backfilled if they are not using it.

5. The on-site instructor ("field" instructor) should make an effort to get to know the supervisors and managers of the currently enrolled students. If supervisors are aware of the training program and the services it is providing, they are more likely to promote and upgrade employees who have completed all or part of the training program. This, after all, is really the final evaluation of the program -- using the training on the job for the betterment of both the employee and the company.

6. Some method of screening should be used when entering prospective students into the program. The primary consideration should be to first consider those students who can benefit directly from the training on the job (assemblers, test technicians, etc.), then those who benefit indirectly (customer service representatives, inventory clerks, etc.), and finally those who really cannot use the knowledge on the job at all, but may anticipate a job change in the future into the technical area (a secretary is a good example of this category). This method of screening is helpful when there are more applicants than openings, and decisions need to be made as to who will enter the program and who will be placed on a waiting list.

7. Another helpful screening tool is an entrance exam. This exam should typically test basic aptitudes for electronics without testing knowledge in electronics. Knowledge in basic mathematics and algebra is a must, and some testing on logical reasoning, problem solving and the like is very helpful in determining whether or not an applicant will be successful in the training program. There are a number of standardized tests available which will help satisfy this requirement.

8. When open slots exist on the training station, and there are few names on the waiting list, it is a good idea to promote the training program through publicity. This is most effectively done through articles in the company newspaper, flyers posted on company bulletin boards, and memos to supervisors. Of course, the most effective method of advertising the program is word-of-mouth from employee to employee. However, this usually takes some time to initiate before it is an effective method.

9. Graduates from the course are one of the best ways of promoting it in the future. When entering students see that a

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number of their fellow employees have completed the program, it seems like a much more reasonable goal for them to complete it as well. This is particularly true if these graduates have received promotions or better or more interesting jobs as a result of the training.

10. The on-site instructor should always strive to maintain very close contact with each student on a one-to-one basis. The cornerstone of the training program is the fact that the instructor is a resource to the student when needed, answering questions or solving problems which the student cannot handle on his/her own. If students feel they can get assistance from the instructor when they need it, they are much more willing to put forth the effort required for them to complete the training.

CONCLUSIONS

As with any new program, the Electronics Worksite Training program needs a reasonable amount of time to be accepted as a regular part of the company environment. Portland Community College's program is achieving these goals, and should become very successful. It is important to realize that the best instructional design package will not be successful without proper implementation. An on-site instructor who places his students as top priority, and works with them on an individual basis as they progress through the program, is virtually guaranteeing the success of the program at the company.

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